

# Beyond Earth: Deep Research on the Most Important Breakthroughs and News in Space and Aerospace from the Past 7 Days

China's first-ever emergency spacecraft launch and a significant SpaceX Starship setback dominated a week that also saw major advances in AI-controlled satellites, orbital refueling contracts, and continued momentum in the global race for space dominance. The November 19-26, 2025 period demonstrated both the remarkable capabilities and persistent vulnerabilities of humanity's space infrastructure, as debris struck a crewed spacecraft while new propulsion technologies and autonomous systems moved closer to operational reality. Against this backdrop, the European Space Agency convened its crucial Ministerial Council, South Korea achieved a milestone in private-sector launch capability, and U.S. policymakers issued stark warnings about China's accelerating space ambitions.

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## Space debris threat forces China's historic emergency response

The week's most dramatic event unfolded on **November 25** when China executed the first emergency crewed spacecraft launch in its space program's history. The uncrewed **Shenzhou-22** lifted off from Jiuquan Satellite Launch Center at 04:11 UTC aboard a Long March 2F rocket, ([Space.com](#)) docking with the Tiangong space station just **3.5 hours** later—([South China Morning Post +2](#)) an operation compressed from the standard 45-day preparation timeline to just 16 days.

The emergency stemmed from debris damage to the Shenzhou-20 spacecraft's window, discovered in early November. This left the Shenzhou-21 crew—Zhang Lu, Wu Fei, and Zhang Hongzhang—without a certified escape vehicle ([South China Morning Post](#)) for approximately 10 days, an unprecedented situation that forced an extraordinary response. The Shenzhou-20 crew had already returned to Earth on November 14 using the Shenzhou-21 spacecraft, ([Nation Thailand](#)) with Commander Chen Dong setting a Chinese record of **418 cumulative days** in space.

The incident underscores the growing space debris crisis: ESA reports approximately **1.2 million** objects larger than 1 centimeter in orbit, each capable of catastrophic damage to spacecraft. ([ESA](#)) Harvard astronomer Jonathan McDowell noted the event raises urgent questions about international cooperation for space rescue scenarios. ([Scientific American](#))

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## Starship development suffers major V3 booster failure

SpaceX's Starship program encountered a significant setback on **November 21** when **Booster 18**—the first "Version 3" Super Heavy—suffered catastrophic structural failure during ground testing at Starbase, Texas. The incident occurred around 4:00 AM local during gas system pressure testing, rupturing the liquid oxygen tank

section and causing extensive damage. [The Register](#) [Space.com](#) No propellant was loaded and no engines were installed; there were no injuries.

The failure adds uncertainty to NASA's Artemis III lunar lander timeline, as SpaceX holds the contract for the crewed lunar descent system. Acting NASA Administrator Sean Duffy had already begun requesting acceleration plans from both SpaceX and Blue Origin. [SpaceNews](#) SpaceX confirmed plans to stack **Booster 19** in December, maintaining their target of Flight 12 in Q1 2026, though the company now plans at least one suborbital V3 flight before attempting orbital missions.

This represents the second V3-related testing anomaly, following Ship 36's failure in June 2025, [The Register](#) raising questions about composite overwrapped pressure vessel (COPV) reliability in the upgraded design.

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## Propulsion and autonomy systems advance toward operational capability

Several propulsion breakthroughs progressed toward deployment during the week. NASA's **Advanced Electric Propulsion System (AEPS)** continued qualification testing at Glenn Research Center, delivering **12 kilowatts** of power—nearly three times current state-of-the-art Hall thrusters. [The Debrief](#) These thrusters will power the Lunar Gateway's Power and Propulsion Element, enabling sustained operations in lunar orbit. [The Debrief](#)

At Tohoku University in Japan, researchers announced a **bidirectional plasma thruster** that tripled deceleration force compared to previous designs. Developed by Associate Professor Kazunori Takahashi, the system uses argon fuel (cheaper than xenon) and could deorbit debris in approximately 100 days.

[Innovation News Network](#) Laboratory vacuum tests are complete, with in-space demonstration planned.

However, the week also confirmed the **cancellation of NASA's DRACO program** for nuclear thermal propulsion. Originally targeting a 2027 space demonstration, the program was zeroed in the FY2026 budget [Wikipedia](#) after updated analyses showed decreasing launch costs (driven largely by SpaceX) had changed the cost-benefit calculation. [Breaking Defense](#) Focus has shifted to the Air Force Research Laboratory's JETSON program for nuclear electric propulsion. [Breaking Defense](#)

In autonomy, the **LeLaR Project** from Germany's University of Würzburg achieved a world first on October 30 (reported in November): the first AI agent to autonomously control satellite attitude in orbit. Using deep reinforcement learning neural networks aboard the InnoCube 3U nanosatellite, the system maneuvered the spacecraft using reaction wheels without human intervention—[myScience](#) a critical step for deep-space missions where light-speed delays make real-time control impossible.

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## Launch cadence records shattered as commercial space accelerates

SpaceX achieved remarkable milestones in launch cadence, conducting four Starlink missions between November 18-23 that deployed approximately **115 satellites**. The **November 22** mission marked SpaceX's **150th Falcon 9 launch of 2025**, [NASASpaceFlight](#) while the November 20 launch became the **100th orbital launch** from Florida's Space Coast this year. [Spaceflight Now](#)

**Rocket Lab** set its own record, completing its **18th Electron launch of 2025** [\(Yahoo Finance\)](#) on November 20 with the "Follow My Speed" mission—surpassing its 2024 total of 16 launches. [\(GlobeNewswire +2\)](#) The company also announced a **December 5** launch date for JAXA's RAISE-4 satellite, the first dedicated Electron mission for the Japanese space agency. [\(Rocket Lab +2\)](#)

**South Korea** achieved a significant milestone on **November 27** when the **Nuri rocket** completed its fourth flight, carrying the **CAS500-3** Earth observation satellite (516 kg) and 12 CubeSats to a 600 km sun-synchronous orbit. [\(ABC News\)](#) [\(ClickOnDetroit\)](#) This was the first Nuri launch led entirely by private company **Hanwha Aerospace**, representing a critical step [\(ClickOnDetroit\)](#) in Korea's goal to capture 10% of the global space economy by 2045. [\(UNN\)](#)

While falling just outside the November 19-26 window, **Blue Origin's New Glenn** second flight on November 13 successfully landed its first-stage booster "Never Tell Me The Odds" on the recovery vessel Jacklyn—making it only the second organization after SpaceX to land an orbital-class rocket. [\(Wikipedia +2\)](#) The company also announced a **9×4 variant** with nine BE-4 engines and four BE-3U upper stage engines, promising over **70 metric tons** to LEO. [\(Aviation Week Network +2\)](#)

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## Orbital refueling takes major step toward European capability

A significant infrastructure development emerged on **November 24** with the announcement of the **ASTRAL contract** (Advancing Satcom Technology with Refueling and Logistics). Worth £1.3 million initially (\$3.8 million total project value), the contract funds **Orbit Fab** and a consortium including KISPE Space Systems (UK) and Gate Space Innovation (Austria) to develop Europe's first in-orbit refueling demonstration by 2028. [\(Payloadspace\)](#)

The mission will demonstrate transfer of nitrous oxide, ethane, and xenon propellants using Orbit Fab's RAFTI (Rapidly Attachable Fluid Transfer Interface) technology. [\(Payloadspace\)](#) The capability has explicit defense implications, with the consortium noting its criticality for NATO operations in contested geostationary orbit. [\(Payloadspace\)](#)

The U.S. Space Force is pursuing parallel initiatives: **Tetra-5** (2026) will test RAFTI technology with Astroscale, while **Tetra-6** (2026-2027) will demonstrate the first GEO in-orbit refueling and satellite dismantling using Northrop Grumman's GAS-T tanker. [\(Aviation Week Network\)](#) The **RG-XX** program will make next-generation space surveillance satellites the first operational refuelable systems. [\(Aviation Week Network\)](#)

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## Space station transitions accelerate amid program modifications

**Artemis II** reached a major milestone on **November 20** when the Orion spacecraft was fully stacked atop the Space Launch System at Kennedy Space Center's Vehicle Assembly Building. [\(EarthSky\)](#) The mission—targeting **February 2026**—will be the first crewed lunar journey since Apollo 17 in 1972, [\(EarthSky\)](#) carrying NASA astronauts Reid Wiseman, Victor Glover, and Christina Koch alongside Canadian Space Agency astronaut Jeremy Hansen on a 10-day circumlunar flight.

The **Lunar Gateway's** components continue advancing: the HALO module arrived in the United States in April 2025 and is undergoing integration at Northrop Grumman's Arizona facility, while the Power and Propulsion Element's propulsion module nears completion at Maxar Space Systems. (NASA) Launch remains targeted for no later than **December 2027** on a SpaceX Falcon Heavy. (NASA)

**Boeing Starliner** faced significant contract modifications announced **November 24**: NASA reduced the program from six to four definitive missions, with the next flight (**Starliner-1**) converted to **cargo-only** for in-flight validation of propulsion system upgrades following the troubled June 2024 Crew Flight Test. (NASA) (Bloomberg) Boeing has reported approximately **\$2 billion** in losses on the fixed-price contract. (Orlando Sentinel) (SpacePolicyOnline.com)

The **ESA Ministerial Council** (November 26-27 in Bremen, Germany) convened 23 member states to decide the agency's 2026-2028 budget, (ESA) with key programs including the European Launcher Challenge for commercial providers, the NewAthena X-ray observatory, and the Ramses asteroid mission targeting Apophis in 2029. (ESA)

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## Regulatory reform advances amid shutdown recovery

The week saw continued recovery from the **43-day U.S. government shutdown** (the longest in history), which ended November 12. The FAA had imposed nighttime-only launch restrictions (10 PM to 6 AM) due to air traffic controller staffing shortages, (Spectrum News) delaying several missions. (Spaceflight Now) Normal operations resumed November 16.

The **FCC** advanced comprehensive space licensing reform through a Notice of Proposed Rulemaking that would extend most license terms to **20 years**, create a new "Variable Trajectory Spacecraft Systems" category, and establish mandatory debris ephemeris data sharing. FCC officials stated the goal is creating the "friendliest regulatory environment in the world" for space commerce. (FDD)

The **U.S.-China Economic and Security Review Commission** released its 2025 annual report on **November 18**, warning that China is pursuing an "aggressive long-term, whole-of-government campaign" to surpass the United States in space. (Breaking Defense) The report noted China's expanding BeiDou constellation (**49 satellites**), (USCC) the Thousand Sails constellation deployment (**90 satellites** launched, 648 more planned by year-end), (War on the Rocks) and PLA counterspace capabilities designed to "degrade, damage, or destroy" U.S. satellites. (Breaking Defense)

China responded with its own initiative: on **November 26**, CNSA released a two-year action plan to support commercial space firms, including access to national tracking facilities, a national commercial space development fund, and debris data sharing for collision warnings. (China.org.cn)

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## Strategic implications reshape the space economy

The week's events illuminate several converging trends that will define the next phase of space exploration and

commercialization. **Reusability is now a competitive standard:** Blue Origin's successful New Glenn landing confirms that SpaceX's approach is replicable, [Wikipedia](#) while both companies race to demonstrate heavy-lift reusable systems that could reduce costs by an order of magnitude.

**Space debris has transitioned from theoretical concern to operational crisis.** The Shenzhou-20 incident marks the first publicly confirmed debris damage to a crewed spacecraft requiring emergency response.

[Phys.org](#) With launch rates accelerating (273+ successful orbital launches globally in 2025 versus 259 in 2024), [Wikipedia](#) conjunction risks will multiply.

**National competition is intensifying.** The USCC report's warning that China threatens U.S. space leadership [SpaceNews](#) coincides with China's demonstration of rapid-response capability in the Shenzhou-22 emergency—achieving in 16 days what typically requires 45. South Korea's private-sector Nuri success, meanwhile, signals expanding participation in what was once a superpower duopoly.

**The commercial space station transition faces tightening timelines.** With ISS decommissioning scheduled for 2030, [Phys.org](#) Dream Chaser delays, and Starliner setbacks, NASA's Commercial LEO Destinations program faces pressure to deliver private stations (Vast's Haven-1, [Phys.org](#) Axiom's modules, Blue Origin's Orbital Reef) before the gap materializes.

The Starship V3 failure adds uncertainty to Artemis lunar ambitions, but SpaceX's demonstrated resilience—150 Falcon 9 launches this year, continued test campaign acceleration—suggests the setback represents a delay rather than a derailment. The coming weeks will reveal whether rapid recovery remains possible as systems grow more complex, stakes grow higher, and the world increasingly depends on infrastructure beyond Earth.